Pacific Gas and Electric Company

Brian K. Cherry
Vice President
Regulation and Rates

Pacific Gas and Electric Company
Mail Code B10C
P.O. Box 770000
San Francisco, CA 94177

Fax: 415.973.6520

November 28, 2011

Advice 3956-E
(Pacific Gas and Electric Company ID U 39 E)

Public Utilities Commission of the State of California

Subject: SmartMeter™ Home Area Network (HAN) Implementation Plan

Pacific Gas and Electric Company ("PG&E") hereby submits for filing its SmartMeter™ Home Area Network ("HAN") Implementation Plan.

Purpose

The purpose of this advice letter is to comply with Ordering Paragraph ("OP") 11 of Decision ("D.")11-07-056 ("Decision"), which requires PG&E, Southern California Edison Company ("SCE"), and San Diego Gas & Electric Company ("SDG&E") to file a Tier 3 advice letter within four months to develop SmartMeter™ Home Area Network ("HAN") implementation plans specific to each electric utility.

Background

In D.11-07-056, the California Public Utilities Commission ("CPUC" or "Commission") ordered PG&E, SCE, and SDG&E to develop a HAN implementation plan that "should include an estimated roll-out implementation strategy, including a timetable for making HAN functionality and benefits generally accessible to customers in a manner similar across all three companies."[1] The Commission directed that the HAN Implementation Plans should include "an initial rollout of up to 5,000 HAN devices, which would allow for HAN activation for early adopters upon request, even if full functionality and roll-out to all customers awaits resolution of technology and standard issues."[2] D.11-07-56 also requires that the implementation strategy for HAN activation "discuss key issues, such as costs, expanded data access and data granularity, current and evolving national standards and security risk mitigation and best practices, responsibilities for

[1] OP 11, D.11-07-056.
[2] Ibid.

secure HAN connection , outcomes from working on HAN device interoperability, security testing and certification methodologies developed in collaboration with interested third parties, customer needs and preferences, a strategy for learning from the initial rollout, and provisions for accommodating customers' efforts to utilize HAN functionality independent of the utility."[3] Lastly, D.11-07-056 orders that the "full roll-out shall require smart meters to transmit energy usage data to the home so that it can be received by a HAN device of the customer's choice."[4]

In Attachment 1, PG&E presents its SmartMeter™ Home Area Network Implementation Plan.

Protests

Anyone wishing to protest this filing may do so by letter sent via U.S. mail, by facsimile or electronically, any of which must be received no later than **December 19, 2011,** which is 21 days from the date of this filing.[5] Protests should be mailed to:

CPUC Energy Division
Tariff Files, Room 4005
DMS Branch
505 Van Ness Avenue
San Francisco, California 94102

Facsimile: (415) 703-2200
E-mail: jnj@cpuc.ca.gov and mas@cpuc.ca.gov

Copies also should be mailed to the attention of the Director, Energy Division, Room 4004, at the address shown above.

The protest also should be sent via U.S. Mail (and by facsimile and electronically, if possible) to PG&E at the address shown below on the same date it is mailed or delivered to the Commission:

---

[3] Ibid.
[4] Ibid.
[5] Since the end of the protest period falls on a weekend, the protest period has been moved to the following business day.

Brian Cherry
Vice President, Regulation and Rates
Pacific Gas and Electric Company
77 Beale Street, Mail Code B10C
P.O. Box 770000
San Francisco, California 94177

Facsimile: (415) 973-6520
E-mail: PGETariffs@pge.com

Effective Date

As directed in D.11-07-056 Ordering Paragraph 11, PG&E submits this advice letter as **Tier 3** advice letter. PG&E requests that this advice filing become effective upon Commission approval.

Notice

In accordance with General Order 96-B, Section IV, a copy of this advice letter is being sent electronically and via U.S. mail to parties shown on the attached list and the service list for R.08-12-009. Address changes to the General Order 96-B service list and all electronic approvals should be directed to e-mail PGETariffs@pge.com. For changes to any other service list, please contact the Commission's Process Office at (415) 703-2021 or at Process_Office@cpuc.ca.gov. Advice letter filings can also be accessed electronically at http://www.pge.com/tariffs/.

Brian Cherry/ene

Vice President – Regulation and Rates

cc: Service List for R.08-12-009

Attachments: Attachment 1 – PG&E's SmartMeter™ Home Area Network Implementation Plan

CALIFORNIA PUBLIC UTILITIES COMMISSION

ADVICE LETTER FILING SUMMARY

ENERGY UTILITY

MUST BE COMPLETED BY UTILITY (Attach additional pages as needed)

Company name/CPUC Utility No. **Pacific Gas and Electric Company (ID U39 M)**

Utility type:	Contact Person: Linda Tom-Martinez
☑ ELC ☑ GAS	Phone #: (415) 973-4612
☐ PLC ☐ HEAT ☐ WATER	E-mail: lmt1@pge.com

EXPLANATION OF UTILITY TYPE

ELC = Electric GAS = Gas
PLC = Pipeline HEAT = Heat WATER = Water

(Date Filed/ Received Stamp by CPUC)

Advice Letter (AL) #: **3956-E** **Tier: 3**

Subject of AL: **SmartMeter™ Home Area Network (HAN) Implementation Plan**

Keywords (choose from CPUC listing): Compliance, Metering

AL filing type: ☐ Monthly ☐ Quarterly ☐ Annual ☑One-Time ☐ Other _____

If AL filed in compliance with a Commission order, indicate relevant Decision/Resolution #: D.11-07-056

Does AL replace a withdrawn or rejected AL? If so, identify the prior AL: No

Summarize differences between the AL and the prior withdrawn or rejected AL[1]: _____

Is AL requesting confidential treatment? If so, what information is the utility seeking confidential treatment for:

Confidential information will be made available to those who have executed a nondisclosure agreement: ☐ Yes ☐ No

Name(s) and contact information of the person(s) who will provide the nondisclosure agreement and access to the confidential information: _____

Resolution Required? ☑Yes ☐No

Requested effective date: **Upon Commission Approval** No. of tariff sheets:

Estimated system annual revenue effect (%): N/A

Estimated system average rate effect (%): N/A

When rates are affected by AL, include attachment in AL showing average rate effects on customer classes (residential, small commercial, large C/I, agricultural, lighting).

Tariff schedules affected: N/A

Service affected and changes proposed[1]: N/A

Pending advice letters that revise the same tariff sheets: N/A

Protests, dispositions, and all other correspondence regarding this AL are due no later than 20 days after the date of this filing, unless otherwise authorized by the Commission, and shall be sent to:

CPUC, Energy Division
Tariff Files, Room 4005
DMS Branch
505 Van Ness Ave.,
San Francisco, CA 94102
jnj@cpuc.ca.gov and mas@cpuc.ca.gov

Pacific Gas and Electric Company
Attn: Brian Cherry
Vice President, Regulation and Rates
77 Beale Street, Mail Code B10C
P.O. Box 770000
San Francisco, CA 94177
E-mail: PGETariffs@pge.com

PACIFIC GAS AND ELECTRIC COMPANY

SMARTMETER™ HOME AREA NETWORK

IMPLEMENTATION PLAN

NOVEMBER 28, 2011

SMART GRID TECHNOLOGIES

ORDER INSTITUTING RULEMAKING 08-12-009

CALIFORNIA PUBLIC UTILITIES COMMISSION

Prepared in Compliance with Ordering Paragraph 11 of

Decision 11-07-056

PG&E'S SMARTMETER™ HOME AREA NETWORK IMPLEMENTATION PLAN
TABLE OF CONTENTS

1. PG&E'S SMARTMETER™ HOME AREA NETWORK VISION STATEMENT 1

2. BACKGROUND AND SUMMARY OF PG&E'S HAN IMPLEMENTATION PLAN 1

3. HAN IMPLEMENTATION PLAN 4

3.1. THREE PHASES – INITIAL ROLLOUT PHASE, EARLY ADOPTER PHASE, AND MASS MARKET PHASE 4
3.1.1. INITIAL ROLLOUT PHASE: MARCH 1, 2012 TO EARLY 2013 7
3.1.2. EARLY ADOPTERS PHASE: EARLY 2013 TO 2014-2015 9
3.1.3. MASS MARKET PHASE: JANUARY 2014 AND BEYOND 12
3.2. OVERALL HAN IMPLEMENTATION PLAN TIMELINE 12

4. CUSTOMER OUTREACH, EDUCATION AND SUPPORT 13

4.1. PG&E'S CUSTOMER OUTREACH AND EDUCATION STRATEGY FOR LEARNING FROM ITS PHASED HAN IMPLEMENTATION PLAN 14
4.2. PROVISIONS FOR ACCOMMODATING CUSTOMERS' EFFORTS TO UTILIZE HAN FUNCTIONALITY INDEPENDENT OF THE UTILITY 15

5. SECURITY AND STANDARDS APPLICABLE TO HAN IMPLEMENTATION PLAN 15

5.1. CURRENT AND EVOLVING NATIONAL STANDARDS AND SECURITY RISK MITIGATION AND BEST PRACTICES 15
5.1.1. PLATFORM STANDARDS 15
5.1.2. CURRENT STATUS OF ZIGBEE SMART ENERGY PROFILE 2.0 19
5.1.3. PG&E SELECTION CRITERIA 20
5.2. RESPONSIBILITIES FOR SECURE HAN CONNECTION 21
5.3. SECURITY TESTING AND CERTIFICATION METHODOLOGIES DEVELOPED IN COLLABORATION WITH INTERESTED THIRD PARTIES (FOR EXAMPLE, WITH LAWRENCE BERKELEY NATIONAL LABORATORIES OR CALIFORNIA STATE UNIVERSITY-SACRAMENTO) 22

6. INTEROPERABILITY AND COLLABORATION WITH OTHER UTILITIES 23

6.1. OUTCOMES FROM WORKING ON HAN DEVICE INTEROPERABILITY AND COLLABORATION WITH OTHER IOUS 23

7. DATA ACCESS AND GRANULARITY 23

8. NEXT STEPS AND REQUEST FOR COMMISSION APPROVAL AND GUIDANCE 23

1. PG&E's SmartMeter™ Home Area Network Vision Statement

Pacific Gas and Electric Company (PG&E) will enable a SmartMeter™ based Home Area Network (HAN) platform that is responsive to the needs of customers and energy markets, providing near real-time electricity usage data as part of a larger ecosystem of enabling technologies that support customer driven energy management programs.

2. Background and Summary of PG&E's HAN Implementation Plan

Ordering Paragraph 11 of California Public Utilities Commission's (CPUC or Commission) Decision No. 11-07-056 requires PG&E, Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E) to develop and file HAN implementation plans that include the following elements:

1. An estimated roll-out implementation strategy, including a timetable, for making HAN functionality and benefits generally accessible to customers in a manner similar across all three companies.

2. An initial phase with a rollout of up to 5,000 HAN devices, which would allow for HAN activation for early adopters upon request, even if full functionality and rollout to all customers awaits resolution of technology and standard issues.

3. A HAN implementation strategy that discusses key issues, such as:

    a. Costs;
    b. Expanded data access and data granularity;
    c. Current and evolving national standards and security risk mitigation and best practices;
    d. Responsibilities for secure HAN connection;
    e. Outcomes from working on HAN device interoperability;

f. Security testing and certification methodologies developed in collaboration with interested third parties (e.g., Lawrence Berkeley National Laboratories or California State University - Sacramento);

g. Customer needs and preferences;

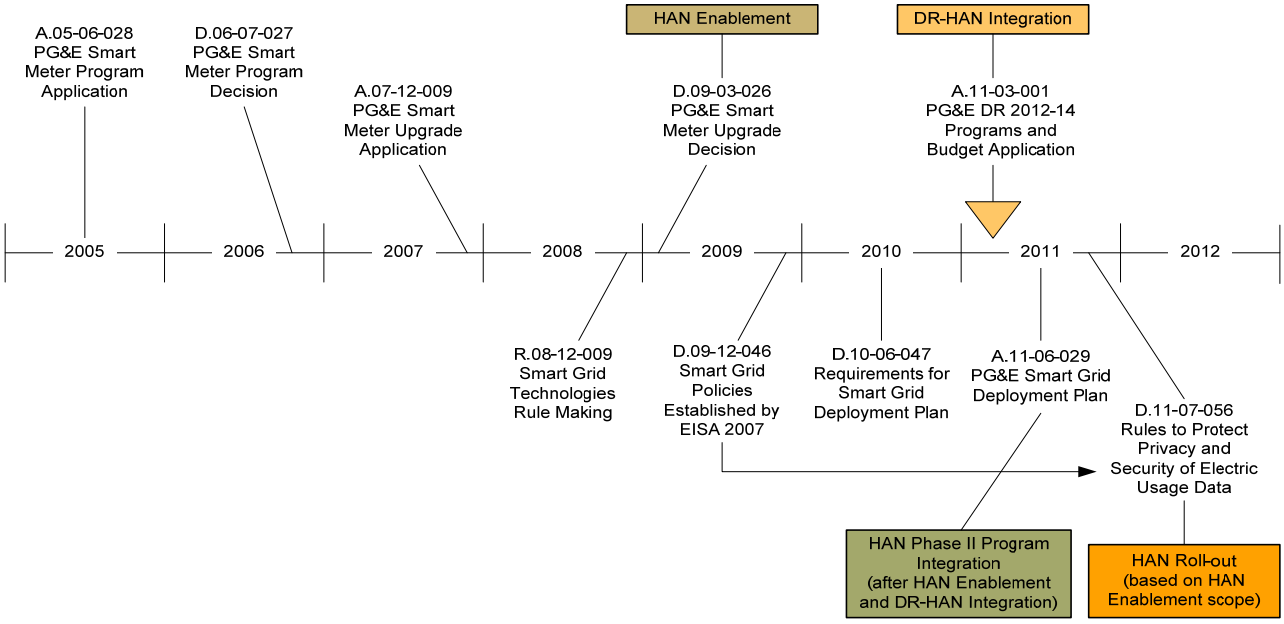
h. A strategy for learning from the initial rollout; and

i. Provisions for accommodating customers' efforts to utilize HAN functionality independent of the utility.

4. A full rollout requiring smart meters to transmit energy usage data to the home so that it can be received by a HAN device of the consumer's choice.

The timeline in Diagram 2.1 below provides timing of key HAN-related regulatory matters which guide PG&E's HAN Implementation Plan:

Diagram 2.1: HAN-Related Regulatory Timeline



As discussed in more detail below, PG&E's HAN Implementation Plan will provide its customers, on a phased schedule, the capability to receive near real time electricity usage data using HAN radio-equipped SmartMeters™ as required by the Commission. The key functionality required to deliver real-time usage includes:

1. SmartMeters™ equipped with HAN radios and appropriate meter firmware; and

2. Back-office process and systems which allow customers to register a HAN-enabled usage display device. The registration process authorizes the device to communicate with the customer's specific meter only.

PG&E will provide the required HAN platform capability and HAN devices for up to 500 customers on an initial rollout beginning March 1, 2012, with full, end-to-end customer registration and technical support.

If the results of the initial rollout and the market for third-party HAN devices indicate sufficient additional customer and vendor support for this HAN capability, PG&E will expand its HAN program to up to 5,000 customers in late 2012/early 2013, including compatibility testing of a limited number of commercially available third-party HAN devices, which can be registered by customers for HAN use.

If the expansion of HAN to 5,000 early adopter customers in 2013 is successful and a sufficient Smart Energy Protocol (SEP) 2.0 device market develops, PG&E will be prepared to enable the HAN platform to support broader mass market adoption.

Table 2.1 below summarizes PG&E's HAN capability deployment, scale, timing and guiding regulatory documentation.

Table 2.1: PG&E's HAN Implementation Plan Summary

Phase Description	Capability	Scale	Timing	Guiding Regulatory Decision
Initial Rollout Phase	Near real-time energy usage (SEP 1.0)	500 (early adopters)	March to December 2012	Smart Meter™ Upgrade Program and Smart Grid OIR Privacy Decisions
Early Adopter Phase	Near real-time energy usage (SEP 1.0/1.X)	Up to 5,000 (early adopters)	Late 2012, Early 2013 start	Smart Meter™ Upgrade Program and Smart Grid OIR Privacy Decisions
Mass Market Phase	Near real-time energy usage (SEP 2.0)	All customers	Late 2013, Early 2014 start	SmartMeter™ Upgrade Program Decision

3. HAN Implementation Plan

3.1. Three Phases – Initial Rollout Phase, Early Adopter Phase, and Mass Market Phase

Prior to 2011, PG&E anticipated its initial HAN deployment would be based on a robust standards based environment and market availability of third-party HAN devices based on the Zigbee SEP 2.0 standard. This standard is currently still in review after a number of delays. This is a significant delay from PG&E's original HAN implementation plan as envisioned by the SmartMeter™ Upgrade Decision. At the request of the Privacy Decision ordering paragraphs to accelerate deployment of HAN functionality, PG&E is choosing to execute a three phase plan whose initial phases will utilize SEP 1.0 devices. SEP 1.0 standard is the only standard currently supported by manufactured devices in the marketplace.

The three phases include:

1. **Initial Rollout Phase:** March 1, 2012 to Early 2013.

2. **Early Adopter Phase:** Early 2013 to Early 2014-2015.

3. **Mass Market Phase:** January 2014 and Beyond.

The **Initial Rollout Phase** will use 500 HAN devices provided to 500 volunteer and employee customers starting on March 1, 2012.

Following successful completion of the **Initial Rollout Phase**, if assessment of the customer experience and third-party market developments indicates sufficient customer and vendor support, PG&E will rollout its **Early Adopters Phase** in early 2013, which will open up potential participation to up to 5,000 customers who purchase and register their own HAN devices.

Finally, if the **Early Adopters Phase** is successful and the third-party HAN device market has developed sufficiently to support broader deployment, PG&E will seek to open up its HAN platform to all third-party HAN devices that meet PG&E's certification and registration standards beginning in the 2014-2015 time period (**Mass Market Phase**).

PG&E has established a set of four specific objectives for the initial two deployment phases (through the end of 2013). The four objectives are as follows:

1. **Deployment Scale:** The platform will support up to 5,000 HAN devices by the end of 2013.

2. **Customer Experience:** Provide an engaging and simple customer experience for early adopters—from device acquisition, to installation/activation and timely customer issue resolution support.

3. **Lessons Learned/Market Driven Incremental Deployment:** Utilize lessons learned from initial rollout phase to shape the early adopter phase experience. Monitor HAN device market development to prepare for mass market deployment.

4. **PG&E Systems and Process Scalability:** Develop PG&E processes and systems with ability to grow beyond the early adopter 5,000 device deployment to a mass market adoption phase.

The following timeline will guide PG&E's 2012-13 activities during the **Initial Rollout Phase,** including the transition between the **Initial Rollout Phase** and the **Early Adopters Phase**:

- **October 2011 to March 1, 2012:** Back-office (UtilityIQ (UIQ) HAN Communications Manager (HCM) software) deployment and configuration.
- **October 2011 to March 1, 2012:** Customer Operations preparation and training for customer outreach, registration, and support activities.
- **October 2011 to March 1, 2012:** Meter firmware testing and certification.

If the three critical items listed above are complete, then:

- **March 1, 2012 to July 30, 2012:** Commence 500 device deployment and customer registration.
- **January 1, 2012 to July 1, 2012:** Complete implementation of scaled up customer registration system to support **Early Adopters Phase**.
- **August to December 2012:** Develop, launch, and identify customer survey and lessons learned from the **Initial Rollout Phase.**
- **August to December 2012:** Evaluate and assess the market for and possible certification of other SEP 1.0/1.X In-Home Display/Gateway devices for **Early Adopters Phase** rollout.
- **Early 2013:** Implement **Early Adopters Phase** for up to 5,000 early adopters who can purchase and install their devices (using PG&E approved in-home

display devices and device web registration system). Utilize first-come, first-served approach for qualified customers.

A more detailed discussion of each of these three HAN implementation phases is provided below.

3.1.1. Initial Rollout Phase: March 1, 2012 to Early 2013

PG&E initiated the **Initial Rollout Phase** efforts in August 2011. Current readiness of underlying components, including UIQ (Silver Spring Networks Head-End software) and HAN Firmware make SEP 1.0 the only possible option for deployment of a HAN platform by March 1, 2012. PG&E will strive to meet the March 1, 2012 deadline as ordered by the CPUC. Successful deployment by this date is dependent on several key factors, including PG&E's vendor's delivery of required firmware and head-end software in time for testing and certification by PG&E, and successful testing by PG&E to ensure that there are no critical defects or compatibility issues that would adversely affect activities such as billing or data collection from other meters in PG&E's Advanced Metering Infrastructure (AMI) network. PG&E also has other ongoing projects that are affected by UIQ and meter firmware changes which must be carefully coordinated. If not, the HAN deployment schedule could be impacted.

As part of this **Initial Rollout Phase** launch to validate platform capabilities and evaluate new technologies, PG&E will provide up to 500 customers with usage display devices. These devices are compatible with PG&E's Silver Spring Networks SmartMeter™ system and are capable of receiving near real-time electric usage from their SmartMeter™. Installation and activation of customer devices will begin in March 2012. As part of a customer engagement plan being developed, PG&E is currently evaluating potential customers for the **Initial Rollout Phase**.

Features of the **Initial Rollout Phase** include:

- PG&E provided color touch screen devices;

- High touch customer experience;
- Fully enabled customer support;
- Integrated knowledge capture/lessons learned; and
- Security driven best practices.

Proven Color Touch Screen Usage Displays: PG&E selected the Control4 EC-100 In-Home Display device, as shown below, to be provided to Initial Rollout Phase customers free-of-charge. This HAN device is currently used in a large pilot at

Oklahoma Gas and Electric (which currently uses the Silver Spring Networks SmartMeter™ system). This SEP 1.0 device provides near real time electric usage information for customers on color touch screen. The device also has Wi-Fi connectivity and can serve as a gateway device allowing access to internet based data. Use of the Wi-Fi capability is currently under review by PG&E to ensure it addresses appropriate security and privacy concerns. If the risk of activating the Wi-Fi gateway is deemed unacceptable, the **Initial Rollout Phase** will not utilize the gateway capability.

Customers will be provided with near real time electric usage from the meter.
If systems testing results warrant, PG&E may also provide limited cost information (note: this will only address customers on E-1 residential rates) and historical data.

High Touch Customer Experience: PG&E will provide in-home professional installation/registration of the 500 in-home display devices. The focus of the professional install is to provide a positive, success-oriented customer experience up front. While this install/register process is not a long-term cost effective solution, it is important in ensuring a positive customer experience with our customers for a highly

visible technology program. Professional installation also provides PG&E with an opportunity to gain field experience with potential connectivity issues that should be expected in early phases of HAN deployment. Installers will also be able to troubleshoot the same without excessively inconveniencing customers.

Fully Enabled Customer Support: Based on our SmartMeter™ experience, PG&E will provide HAN contact center personnel and other operations center support staff trained to quickly resolve issues associated with the HAN functionality. PG&E systems will alert contact center personnel to route HAN related calls to a specially trained HAN support team member.

Integrated Knowledge Capture/Lessons Learned: Active customer engagement through surveys and problem analysis will provide a knowledge base to develop lessons learned for the larger rollout to early adopters in 2013. Customers will be asked to commit to provide feedback in return for use of the device.

Security Driven Best Practices: The implementation plan will incorporate results of a security risk management plan and will be consistent with industry security standards such as the new National Electric Sector Cyber-Security Organization Resource SEP 1.x security standard (currently in review).

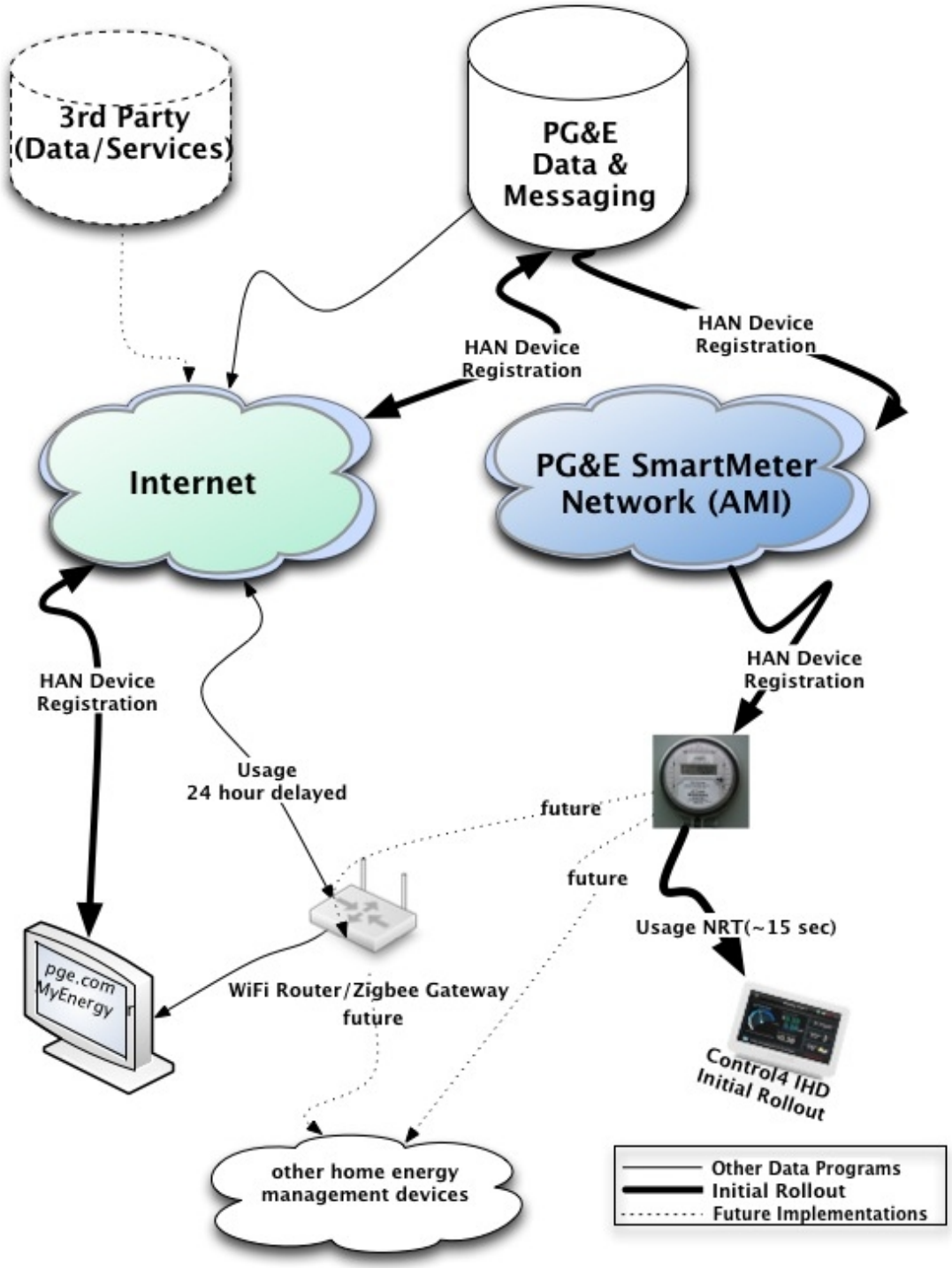
3.1.2. Early Adopters Phase: Early 2013 to 2014-2015

Beginning in early 2013, utilizing the lessons learned from the **Initial Rollout Phase**, PG&E will expand the use of the HAN platform to allow up to 5,000 early adopters to purchase (either retail or directly from a manufacturer) and install a PG&E approved device. The key *additional* features to be implemented in 2012 to support a 2013 **Early Adopter Phase** launch include:

Additional Usage Display Device Certification: PG&E will compatibility test a limited number of display devices (SEP 1.X standard) which customers will be able to purchase through retail channels. A list of PG&E approved display devices will be available on www.pge.com. PG&E is currently planning an Request for Information/Solicitation to the market to define appropriate device types (e.g., in-home display devices, gateways) and supporting business models (certification and channel delivery)—for both SEP 1.X and potentially SEP 2.0 devices. (It should be noted that significant back office and meter firmware modifications will be required to support SEP 2.0 device deployment.) Promotion of the availability of the HAN platform is anticipated to be marketed on www.pge.com as an early adopter program, with a list of approved devices and other participation requirements. One potential investor-owned utilities (IOU) collaboration area to explore is a SEP 2.0/2.X interoperability lab which would provide customers with greater confidence to take their devices from one IOU service territory to another. PG&E supports on-going discussions with SDG&E and SCE to assess the feasibility of such an approach due to the significant network/meter architecture differences between PG&E and the other two IOUs.

Web Based Device Registration/Activation (Ready Mid-2012): A web self-service registration capability will be implemented by mid 2012 permitting customers to register PG&E approved display devices. This function will not only authorize required device "pairing" with a customer's meter, but also alert PG&E's customer contact center personnel with information about customers with HAN devices. This allows HAN inquiries to be efficiently routed to a dedicated team of HAN specialists. It should be noted that this approach also accommodates scaling for the **Mass Market Phase** rollout. An overview of the platform architecture, including the registration function is shown in Diagram 3.1 below:

Diagram 3.1: PG&E Data Architecture



3.1.3. Mass Market Phase: January 2014 and Beyond

If the **Early Adopters Phase** is successful in both customer satisfaction and third-party vendor participation and device certification, then in 2014 or 2015, PG&E will open its HAN platform to mass registration and customer support. This **Mass Market Phase** will also depend upon the successful completion of appropriate national standards, such as SEP 2.0 to support secure, interoperable, and reliable mass market deployable HAN devices that are accurate and convenient for consumer use. PG&E will carefully monitor and apply "lessons learned" from the earlier phases of its HAN implementation plan as well as market developments before implementing this phase.

As PG&E learns about customer and technology aspects of HAN in-home display device deployment prior to the **Mass Market Phase**, PG&E will continue to monitor HAN market developments. This will include maturation of the SEP 2.0 and security/privacy standards, deployment of dynamic pricing models, customer-driven energy efficiency and demand response programs, a potential market-driven platform decision between internet provided data and HAN provided data, and development of a viable device retail channel market. In addition, funding and cost recovery for operation of the HAN platform and back-office systems to support mass market deployment, including certification of third-party devices; customer registration and technical support; security controls; and operation and maintenance of the HAN network, will be required before implementation of this phase.

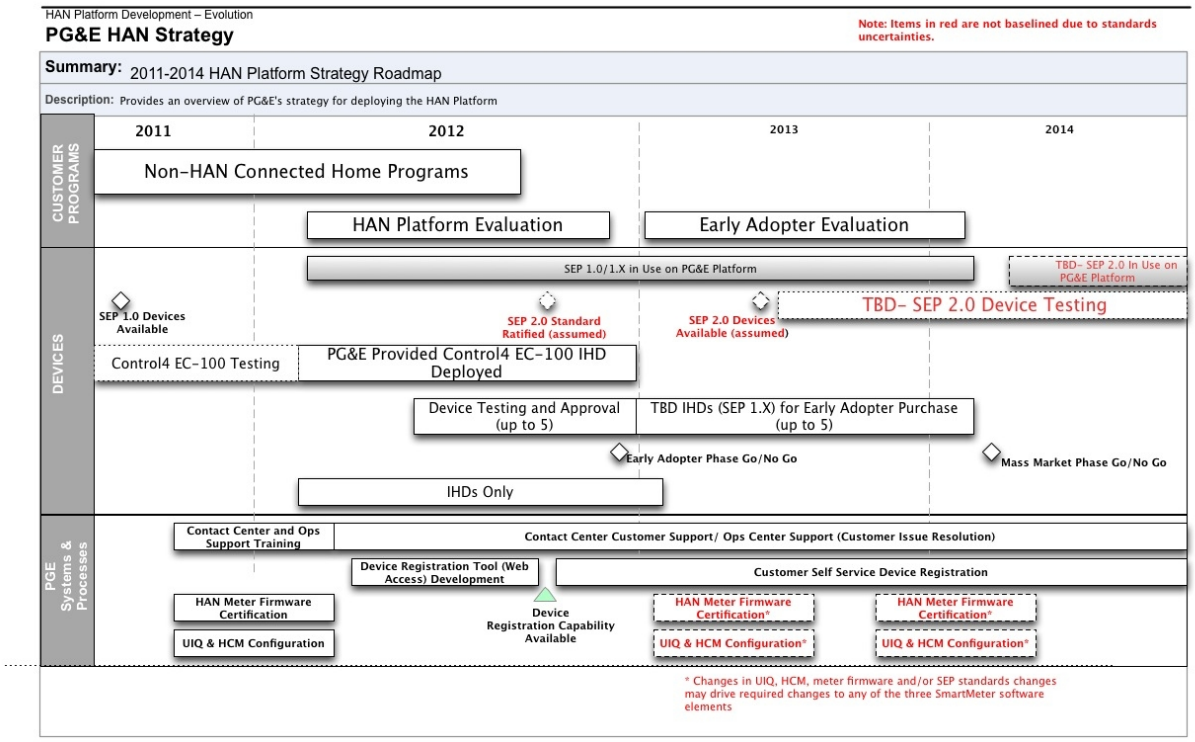
3.2. Overall HAN Implementation Plan Timeline

Diagram 3.2 below provides a high level overview of PG&E's proposed HAN Implementation Plan timeline. The three key dependencies that PG&E has integrated into its overall SmartMeter™ operations to develop its initial HAN Implementation Plan timeline are:

- In-Home display device certification
- Meter HAN firmware certification

- Integration of HAN Control Module software with PG&E's UIQ head-end system

Diagram 3.2: PG&E's HAN Strategy Roadmap



4. Customer Outreach, Education and Support

Prior to rolling out HAN network services to customers, PG&E will complete a customer outreach and education plan. This will ensure that customers who use HAN devices and connect those devices to PG&E's HAN network are fully aware of the attributes and benefits of the new technology as another tool to assist in understanding and managing energy use. PG&E's customer research and analysis, as well as its experience with SmartMeter™ technology, has demonstrated that this preliminary customer outreach and education is essential to a positive and beneficial customer experience with the new HAN technology.

The good news in the results of a smart meter/home automation trial conducted by CenterPoint Energy is that in-home displays can encourage conservation and energy awareness.

Seventy-one percent of the 500 participants said that they took actions to lower their energy consumption as a result of having an energy monitor….

…Time-of-use and peak-pricing plans would make HAN valuable even after retrofits and systemic fixes like swapping light bulbs are taken, but most consumers aren't on dynamic pricing plans.

A total of 84 percent claimed they would continue using their in-home displays, and 42 percent said they would definitely recommend them to their friends.

Kanellos, Michael. "HAN Technology Teaches Americans to Turn Lights Off at Night." Greentech Media July 26, 2011. Web.

4.1. PG&E's Customer Outreach and Education Strategy for Learning from Its Phased HAN Implementation Plan

As part of all phases of its HAN Implementation Plan, PG&E will actively engage with the initial 500 rollout customers, the early adopters in the second phase, and the **Mass Market Phase**. The plan to capture learning includes:

- Full and customized customer support for initial installation, registration and use of the HAN devices.
- Obtaining customer feedback on the in-home display devices (Control4 EC-100 and other approved in-home display devices).
- Obtaining customer feedback on the registration and customer support process.
- Objective evaluation of the technology (connectivity stability, accuracy).
- Evaluate the device certification; registration and customer support processes to establish a sustainable model for early adopters and later

Mass Market Phase rollout of devices associated with future programs and customer needs.

4.2. Provisions for Accommodating Customers' Efforts to Utilize HAN Functionality Independent of the Utility

PG&E believes that for the foreseeable future, customers will need to register/deregister devices with PG&E because as the current SmartMeter™ architecture requires that any new HAN device(s) be recognized by the meter as a trusted device, as the current HAN provisioning capability requires integration of the HAN device with PG&E's SmartMeter™ back office applications (UIQ HCM). However, as part of PG&E's ongoing evaluation of new technologies associated with advanced metering, PG&E will monitor alternative solutions, which may include a gateway device which could communicate via the HAN link with the meter and ZigBee or via Wi-Fi to downstream devices (e.g., programmable communicating thermostats, electric vehicle systems, and smart appliances). PG&E will monitor customer preferences and HAN market developments and adjust its HAN Implementation Plan as appropriate.

5. Security and Standards Applicable to HAN Implementation Plan

5.1. Current and Evolving National Standards and Security Risk Mitigation and Best Practices

5.1.1. Platform Standards

All of PG&E's electric meters contain an 802.15.4 ZigBee HAN radio, which is consistent with the HAN radio selection of the majority of the utility industry. Most of the installed and planned smart meters at other utilities also contain a ZigBee radio for HAN communications to connect a premise with the grid. Other non-radio frequency (RF) solutions available in the marketplace for the utility to communicate with a customer include powerline carrier solutions. A broadband (internet) solution may also be a viable solution for delivering pricing, messages, and load control signals, however the ZigBee channel is a unique connection to the utility since the AMI network is fully owned and operated by the utility and is perceived by some to be more reliable for key

messages (e.g., demand response) than third-party-owned internet connections within a home. About 30 percent of California residents do not have a broadband internet connection.[1] The AMI channel will be used to at least deliver a minimum set of information (e.g., real-time consumption and demand) to our customers that would like this information and to provide universal coverage and benefits to those customers without a broadband connection.

ZigBee was selected as the HAN communication protocol at PG&E based on the following functionality assessment:

- Low cost;
- Low power usage; and
- Mesh networking and reach.

The dominant standard to date within this market has been the ZigBee SmartEnergy (ZSE) protocol. The ZSE 1.0 protocol (released in December 2004) left many items optional and lacked many of the security items needed to realize a truly secure, interoperable, plug and play standard. The SEP 2.0 specification is intended to close these gaps and is widely seen as the way towards a dominant meter to in-premise communication. The ZigBee SEP 2.0 specification is an IP-based application specification that has been identified by ZigBee Alliance, Wi-Fi Alliance, HomePlug Alliance, the Society of Automobile Engineers (SAE), and the National Institute of Standards and Technology (NIST) as the common protocol for energy information and control in the home and for electric vehicles.

[1] Public Policy Institute of California,"California's Digital Divide," August 2010.

Table 5.1 below provides a quick overview of other prominent home energy management standards in the marketplace along with their pros and cons.

Table 5.1: Prominent Home Energy Management Standards

Name	Description	Pros	Cons	Market Presence
Smart Energy Profile 2.0	Standard for interoperable products that monitor, control, inform and automate the delivery and use of energy	▪ Low cost ▪ Low power ▪ Reach within premise (mesh networking)	▪ Path from ZSE1.0 to SEP 2.0 introduces the risk of stranded assets ▪ Limited flash memory in some legacy devices ▪ Uncertainty in standard completion timeline ▪ Uncertainty in interoperability across multiple types of network	Widely seen as the dominant standard by most utilities with AMI deployments (actual and planned)
ZigBee Home Automation (HA)	Standard for interoperable products enabling smart homes that can control appliances, lighting, environment, and security, as well as the expandability to connect with other ZigBee networks	▪ Low cost ▪ Low power ▪ Reach within premise (mesh networking)	▪ Does not support the metering functions needed for communication with utility AMI meters (only for home automation without utility connection). Requires ZigBee HA Gateway	Widely adopted in home automation products Would need to link to ZigBee SmartEnergy (e.g., through a gateway or hub) to connect with the utility

Table 5.1: Prominent Home Energy Management Standards (Continued)

Name	Description	Pros	Cons	Market Presence
Wi-Fi	Institute of Electrical and Electronics Engineers (IEEE) based standard for high speed wireless local area networks (LAN)	▪ Speed. Faster than ZigBee or Z-Wave ▪ Ability to serve up data rich applications ▪ Household penetration of Wi-Fi devices	▪ No open mesh standard is available ▪ Battery powered Wi-Fi may be impractical ▪ May be complicated to re-boot gateway	Wi-Fi is widely adopted and known by consumers Good for gateway applications
HomePlug	HomePlug "Green PHY" specification allows users to plug devices directly into the wall where electrical wires serve as the communications backplane (powerline carrier)	▪ As long as there is electricity, there is a network ▪ Low speed ▪ Low cost ▪ Ease of set up (plug it in) ▪ Enables hard to reach premise connections	▪ Limited data can be transmitted (narrow band communication) ▪ Chipsets are not yet widely available	Not yet a dominant market player but widely seen as a good solution for Multi Dwelling Units (MDU)/hard to reach premises, especially if Home Plug is involved in the development of SEP 2.0
Z-Wave	Proprietary specification	▪ Low frequency/ long range ▪ Reliable signal ▪ Established in retail channels and within home automation and security products ▪ Good interoperability between devices	▪ Proprietary ▪ Membership is expensive	Established in-home automation and security products Not an open standard. Not attractive for utilities/smart grid products, but may be featured in gateway/hub products

5.1.2. Current Status of ZigBee Smart Energy Profile 2.0

In April 2011, the SEP 2.0 application specification (aka the 0.7 version) – a major milestone towards the completion of the standard – failed to pass initial balloting. There are many proposals and options for how SEP 2.0 will evolve going forward. The application spec is at the 0.7 stage, which means there may be proof-of-concept devices emerging by end of 2012 or early 2013. There is still uncertainty about how the standards and the market will evolve in the longer term, especially with regards to moving SEP 2.0 into an independent organization. In addition, more finalized versions of the SEP 2.0 specifications (0.9 and 1.0 versions) require successful interoperability testing among HAN devices from multiple vendors, which creates uncertainty around the timeframe for the finalized specification. PG&E is actively monitoring this market, is a major contributor to the standards processes, and strongly advocates standards-based solutions for our customers.

Currently, efforts are underway to establish a consortium of market participants to enable testing and certification of devices which use multiple types of networking technologies, such as gateways. The consortium would manage the certification, so that devices using a transport layer (or radio) other than ZigBee (e.g., Wi-Fi, HomePlug, etc) could be tested and certified to SEP 2.0. Future efforts may establish an independent testing and certification authority (ITCA), a single legal entity that would own SEP 2.0 independent of transport layer implementation. For example, a customer could buy a SEP 2.0-certified appliance with an empty USNAP port. (USNAP is an acronym for Utility Smart Network Access Port, a solution that enables any HAN standard, present and future, to use any vendor's Smart Meter as a gateway into the home, without adding additional hardware in the meter.) The customer could then purchase a USNAP module with the radio best suited for their specific HAN, and be confident the appliance will smoothly interoperate. There are many variables at play in this effort and timescales are currently uncertain.

Although most utilities (including PG&E) have ZigBee radios embedded within the meter, the road to a true interoperable standard and one which will solve all customer needs (e.g., network reach) has been patchy to date. SEP 2.0 is widely seen as the dominant standard from the meter into the home, and it has emerged as the de facto standard to launch the HAN market. However, it remains to be seen which wireless protocol will become the dominant standard for devices inside the home. This road to a recognized, mature standard is typical in an early market stage and solid standards will be a vital component to HAN market success.

5.1.3. PG&E Selection Criteria

As part of our analysis for HAN enablement, we identified seven major criteria to qualitatively measure each of the standards options available. These include:

- **Core Information Technology Capability:** Head-end/meter firmware readiness.
- **Features:** What customer and PG&E functionality is available in each standard.
- **Current Device Availability:** As noted earlier, this was the overwhelming criteria to meet the March 2012 date.
- **Future Device:** This is a subjective evaluation of near term device availability to support market growth and increased use of the HAN platform.
- **Upgradeability:** Ability for devices to be upgraded to avoid potential stranding of devices with customers.
- **Enablement Costs:** Cost to stand up an enabled HAN platform to support data usage.

- **Future Costs:** This criterion examines potential long term operational costs associated with a specific standard.

PG&E's subjective ranking is provided in Diagram 5.1 below:

Diagram 5.1: PG&E Selection Criteria

	SEP 1.0	SEP 1.1	SEP 2.0
Core IT Capability	Available	Near Future	Not available due to lack of defined std
Features	Limited due to security concerns, i.e. usage only	Limited due to security concerns, i.e. usage only	Better for advanced HAN use cases
Current Device Availability	1.0 devices currently available	Certified vendors announced; products expected in 6-9 months	NA
Future Device Availability	No additional 1.0 device certification	Best near term device selection will be on SEP 1.1	Uncertain, but 2.0 is expected to support a more robust retail channel
Upgradeability	Devices in field unlikely to be upgradeable	Protocol supports over-the-air upgrades	Protocol supports over-the-air upgrades
Enablement Cost	Lowest (less interoperability testing)	Consistent with current budget	Consistent with current budget
Future Cost	Highest should we decide to expand HAN	High should we decide to expand HAN	Lowest cost to expand HAN

5.2. Responsibilities for Secure HAN Connection

PG&E's HAN solution architecture will require a customer to provide device ID information in order for the customer's device to be added to the list of the meter's trusted devices. This registration function currently is maintained by each of the IOUs in California, in part due to the different smart meter solution between PG&E (Silver Spring Networks system) and SCE/SDG&E (Itron system).

5.3. Security Testing and Certification Methodologies Developed In Collaboration with Interested Third Parties (For Example, With Lawrence Berkeley National Laboratories or California State University-Sacramento)

PG&E views cyber security as an essential, fundamental and embedded tenet to the evolution of the Smart Grid. PG&E recognizes that customer HAN devices can present security challenges if deployed without the appropriate controls. Protecting sensitive data, including customer energy use, requires utilities, consumer groups, and vendors to collaborate and develop secure software, hardware, security tools and new standards that are appropriate to this environment. PG&E's existing information security and cyber security policies and standards will be leveraged and further evolved to secure the Home Area Network devices.

Threats in the HAN environment must be well assessed, understood, and addressed in order to protect our networks, customer data and PG&E's overall reputation. As a result, efforts are underway to partner with respective vendors and penetration testing teams to better understand the risks involved with these devices. This evaluation will encompass the cyber and physical risks these devices and overall architecture introduces. Risks identified with this process will be clearly delineated to the business stakeholders so that proper mitigation strategies can be analyzed and executed.

From a process perspective, PG&E performs project specific security reviews for IT related projects throughout the lifecycle of the system development, establishing risk levels against a baseline set of controls defined by the architecture and technology standards process. Security reviews are a condition prescribed by this process.
This project will follow a governing cyber security strategy, framework and plan, together with project-specific cyber security reviews to ensure that appropriate security measures are established in the design. This review will establish the levels of sensitivity for data confidentiality, integrity, and availability during transmission and in storage. Privacy is also considered in this review. Recognized industry resources are used as a baseline reference during the performance of the cyber security review. A key

reference for the cyber security review is the final draft of the National Electric Sector Cyber-Security Organization Resource SEP 1.x Summary and Analysis.

6. Interoperability and Collaboration with Other Utilities

6.1. Outcomes from Working on HAN Device Interoperability and Collaboration with Other IOUs

At the current time statewide interoperability testing for SEP 1.0/1.X devices is not a recommended approach due in large part to the small number of SEP 1.X devices expected to be deployed in anticipation of a SEP 2.0 market. As discussed earlier, we anticipate a joint IOU discussion as to how best to ensure interoperability between SEP 2.X devices in the future.

7. Data Access and Granularity

PG&E envisions near real-time usage data (~15 seconds old) to be provided by the HAN platform while historical usage data will be provided by PG&E's back-office systems through the MyEnergy website or other methods such as OpenADE.

8. Next Steps and Request for Commission Approval and Guidance

PG&E looks forward to expedited Commission review and approval of its HAN Implementation Plan, so that it can implement the HAN Implementation Plan on schedule. In addition, PG&E requests and invites guidance and advice from Commission staff and other interested parties regarding the contents and phases included in this Plan.

PG&E Gas and Electric
Advice Filing List
General Order 96-B, Section IV

AT&T
Alcantar & Kahl LLP
Ameresco
Anderson & Poole
Arizona Public Service Company
BART
Barkovich & Yap, Inc.
Bartle Wells Associates
Bloomberg
Bloomberg New Energy Finance
Boston Properties
Braun Blaising McLaughlin, P.C.
Brookfield Renewable Power
CA Bldg Industry Association
CLECA Law Office
CSC Energy Services
California Cotton Ginners & Growers Assn
California Energy Commission
California League of Food Processors
California Public Utilities Commission
Calpine
Cardinal Cogen
Casner, Steve
Chris, King
City of Palo Alto
City of Palo Alto Utilities
City of San Jose
City of Santa Rosa
Clean Energy Fuels
Coast Economic Consulting
Commercial Energy
Consumer Federation of California
Crossborder Energy
Davis Wright Tremaine LLP
Day Carter Murphy
Defense Energy Support Center
Department of Water Resources
Dept of General Services
Douglass & Liddell
Downey & Brand
Duke Energy
Economic Sciences Corporation
Ellison Schneider & Harris LLP
Foster Farms
G. A. Krause & Assoc.
GLJ Publications
GenOn Energy, Inc.
Goodin, MacBride, Squeri, Schlotz & Ritchie
Green Power Institute
Hanna & Morton
Hitachi
In House Energy
International Power Technology
Intestate Gas Services, Inc.
Lawrence Berkeley National Lab
Los Angeles Dept of Water & Power
Luce, Forward, Hamilton & Scripps LLP
MAC Lighting Consulting
MBMC, Inc.
MRW & Associates
Manatt Phelps Phillips
McKenzie & Associates
Merced Irrigation District
Modesto Irrigation District
Morgan Stanley
Morrison & Foerster
NLine Energy, Inc.
NRG West
NaturEner
Navigant Consulting
Norris & Wong Associates
North America Power Partners
North Coast SolarResources
Northern California Power Association
Occidental Energy Marketing, Inc.
OnGrid Solar
Praxair
R. W. Beck & Associates
RCS, Inc.
Recurrent Energy
SCD Energy Solutions
SCE
SMUD
SPURR
San Francisco Public Utilities Commission
Seattle City Light
Sempra Utilities
Sierra Pacific Power Company
Silicon Valley Power
Silo Energy LLC
Southern California Edison Company
Spark Energy, L.P.
Sun Light & Power
Sunshine Design
Sutherland, Asbill & Brennan
Tabors Caramanis & Associates
Tecogen, Inc.
Tiger Natural Gas, Inc.
TransCanada
Turlock Irrigation District
United Cogen
Utility Cost Management
Utility Specialists
Verizon
Wellhead Electric Company
Western Manufactured Housing Communities Association (WMA)
eMeter Corporation